

# BATOPILASIA (ASTERACEAE: ASTEREAEE), A NEW GENUS FROM CHIHUAHUA, MEXICO

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## ABSTRACT

The Mexican species *Erigeron byei* Sundberg & Nesom is excluded from *Erigeron* and subtribe Conyzinae and treated as the monotypic genus ***Batopilasia*** Nesom & Noyes, gen. nov., and species ***Batopilasia byei*** (Sundberg & Nesom) Nesom & Noyes, comb. nov. *Batopilasia byei* at least superficially resembles the phyletically isolated North American genera *Boltonia* and *Chloracantha* in morphology. DNA studies indicate that *Batopilasia* and *Boltonia* are closely related and suggest that *Boltonia* is closely related to *Chloracantha*. The new genus apparently is restricted to the area of the Barranca del Cobre in southwestern Chihuahua, Mexico. A technical description, illustration, and distribution map are provided.

## RESUMEN

La especie mexicana *Erigeron byei* Sundberg & Nesom se excluye de *Erigeron* y de la subtribu Conyzinae y se trata como género monotípico ***Batopilasia*** Nesom & Noyes, gen. nov., y especie ***Batopilasia byei*** (Sundberg & Nesom) Nesom & Noyes, comb. nov. *Batopilasia byei* se parece al menos superficialmente en su morfología a los géneros norteamericanos filéticamente aislados *Boltonia* y *Chloracantha*. Los estudios de DNA indican que *Batopilasia* y *Boltonia* están muy relacionados y sugieren que *Boltonia* está muy relacionada con *Chloracantha*. El nuevo género aparentemente está restringido al área de Barranca del Cobre en el suroeste de Chihuahua, México. Se ofrecen una descripción técnica, una ilustración y un mapa de distribución.

In the original description of *Erigeron byei* (Sundberg & Nesom 1990), it was regarded as most similar to *E. ortegae* Blake (= *Aster spinosus* Benth.) and *E. oxyphyllus* Greene, these three species constituting *Erigeron* sect. *Spinosi* (*E. ortegae*, the type). A number of essential differences have since been recognized between *E. oxyphyllus* and *E. ortegae*, and the latter has been segregated as the monotypic genus *Chloracantha* (Nesom et al. 1991; Sundberg 1991). *Erigeron oxyphyllus* has been treated as a member of the primarily Californian *E. foliosus* Nutt. group (*Erigeron* sect. *Linearifolii*, Nesom 1992 = sect. *Pycnophyllum*; see Nesom & Noyes 1999). Nesom et al. (1991) noted that although "the evolutionary affinities of *E. byei* may yet prove to lie with [*Chloracantha*], outside of *Erigeron*, there is



insufficient evidence at present ...” to justify its exclusion, and *E. byei* has been maintained in an isolated position within *Erigeron*. Recent study of molecular variation in the tribe Astereae (Noyes & Rieseberg 1999), however, provides evidence that the origin of *E. byei* lies outside the phylogenetic nexus of *Erigeron* and *Conyza* and their closest relatives.

### **Relationship to *Erigeron* and Conyzinae**

*Erigeron byei* was originally placed in *Erigeron* because of its perceived resemblance to *E. ortegae* and *E. oxyphyllus*, but after the recognition of the infra-generic relationship of the latter (within *Erigeron* sect. *Pycnophyllum*) and the transfer of the former to *Chloracantha*, *E. byei* has no close similarity to any other species of *Erigeron* and does not fit into any previously circumscribed section (Nesom 1989). The small, few-flowered heads and the subterete, multinerved cypselas, in particular, are unusual in *Erigeron*, although no single morphological character is sufficient to exclude the species from the genus.

Molecular studies by Noyes and Rieseberg (1999) and Noyes (2000) include representative species of *Erigeron* and close relatives (63 *Erigeron*, representing 20 sections; 6 *Conyza*; 2 *Aphanostephus*; 1 each of *Apopyros*, *Neja*, and *Hysterionica*) and delimit a monophyletic group that corresponds to the Conyzinae of Nesom (1994), with three exceptions: (1) the North American genus *Aphanostephus* arose from within the group, apparently in a sister relationship to *Erigeron bellioides* DC. (and presumably its close relatives), a species native to the Caribbean Islands—these two groups in a sister relationship with a group of species including *E. quercifolius* Lam.; (2) African species of *Conyza* are placed within subtribe Grangeinae rather than Conyzinae; and (3) *E. byei* is related to species outside of the Conyzinae. As so delimited, the species and genera of Conyzinae encompass considerable morphological diversity, but *E. byei* is the only New World species to be excluded.

### **Relationship to *Chloracantha* and *Boltonia***

The hypothesis that *Erigeron byei* is closely related to *Chloracantha* was based on their shared rhizomatous habit, cauline leaves much reduced in size and distribution, persistently green-glabrate stems and leaves, erect buds, distinctly similar phyllaries (thin-herbaceous, apically rounded to obtuse, with three, prominent, orange-resinous nerves), and deltate collecting appendages of the disc corolla style branches. *Boltonia* also shares this combination of habit and capitular features.

In the Noyes and Rieseberg (1999) analysis, *Erigeron byei* is positioned as the sister genus to *Boltonia* and this pair of taxa is then most closely related to *Symphyotrichum*, *Oreostemma*, and genera of subtribe Machaerantherinae. *Chloracantha* was not included in their analysis, but phylogenetic proximity between *Boltonia* and *Chloracantha* had earlier been suggested by cpDNA analyses of Astereae—in the context of broader sampling, Morgan (1990) observed that *Chloracantha* is most closely related to the goldenaster group (subtribe Chrysopsidinae), while Suh (1989) observed the same relationship between *Boltonia* and the goldenasters. A close relationship between *Boltonia* and goldenasters, based on cpDNA evidence, is not corroborated by ITS sequence data



from nuclear ribosomal DNA (Noyes & Rieseberg 1999), but the suggestion remains that *Boltonia* and *Chloracantha* are closely related. A long-standing hypothesis of close relationship between *Boltonia* and the Asian genus *Kalimeris* was rejected by Gu and Hoch (1997) on morphological grounds and by Noyes and Rieseberg (1999), based on molecular evidence.

*Boltonia* remains a genus strongly isolated in morphology (see Cronquist 1980 and Anderson 1987 for taxonomic summaries), differing from *Erigeron byei* in having mostly cauline leaves, conical or convex receptacles, phyllaries with a thick, raised, orangish midrib, short-tubed disc corollas, cypselas broadly elliptic to elliptic-obovate, strongly flattened and broadly winged or unwinged, with a nerve at each margin, these often with conspicuous, orangish oil ducts, and pappus absent or short-coronate, also with several small bristles and 2(–4) much longer, thickened, barbellate awns.

*Chloracantha* differs from *Erigeron byei* primarily in vegetative features—taller stature, thick rhizomes, perennial and lignescent stems with thorns and axillary buds, lack of persistent basal leaves—but also in larger heads and greater number of flowers. The similarities of *Erigeron byei* and *Chloracantha* in their subterete, 4–5-nerved cypselas and pappus of barbellate bristles are probably primitive (plesiomorphic), compared to the highly derived (apomorphic) fruiting features of *Boltonia*.

In summary, although the divergent taxonomic position of *Erigeron byei* was suspected at its original description, based on morphology, its relatively generalized features make it difficult to place the species. In overall morphology, however, *E. byei* is notably similar to the genus *Chloracantha*, and molecular evidence indicates that it is closely related to *Boltonia* and perhaps *Chloracantha*. On the basis of its morphological isolation within *Erigeron* and its unambiguous molecular-phylogenetic placement outside of the Conyzinae, we treat *E. byei* as a monotypic genus.

**Batopilasia** Nesom & Noyes, gen. nov. TYPE: *Batopilasia byei* (Nesom & Sundberg) Nesom & Noyes

A *Chloracanthae* similis vestimento fere glabro, foliis caulinis amplitudine valde redactis, gemmis erectis, phyllariis tenui-herbaceis nervis tribus aurantiacis, flosculis radii laminis albis brevibus circinatis, flosculis disci rami stylores appendicibus deltatis, et acheniis 4–5-nervatis sed differt statura multo minore, habitu caespitose ab rhizomatibus tenuibus vel ramis caudicis rhizomiformibus, foliis basalibus persistentibus in rosetulis coarctatis, capitulis minoribus, et flosculis radii paucioribus. Ab *Erigeronte Conyza* et affinibus late separatus datis molecularibus.

**Batopilasia byei** Nesom & Noyes, comb. nov. (Fig. 1) BASIONYM: *Erigeron byei* Sundberg & Nesom, *Phytologia* 69:278. 1990.

Perennial, caespitose, glabrous herbs from a system of thin, lignescent, rhizome-like caudex branches. Stems 7–20 cm tall, usually with 1–2 ascending branches near midstem. Basal leaves persistent in rosettes, sessile, narrowly elliptic-oblongate, 8–26 mm long, 1–2 mm wide, entire, 1-nerved or faintly 3-nerved, with a mucronulate apex, the cauline leaves few and sharply reduced in size to linear bracts 1–4 mm long. Heads 5–8 mm wide, erect in bud, solitary on nearly naked peduncles 5–10 cm long; phyllaries in 3–4 strongly graduated series, elliptic-oblongate with obtuse to acute apices, thin-herba-



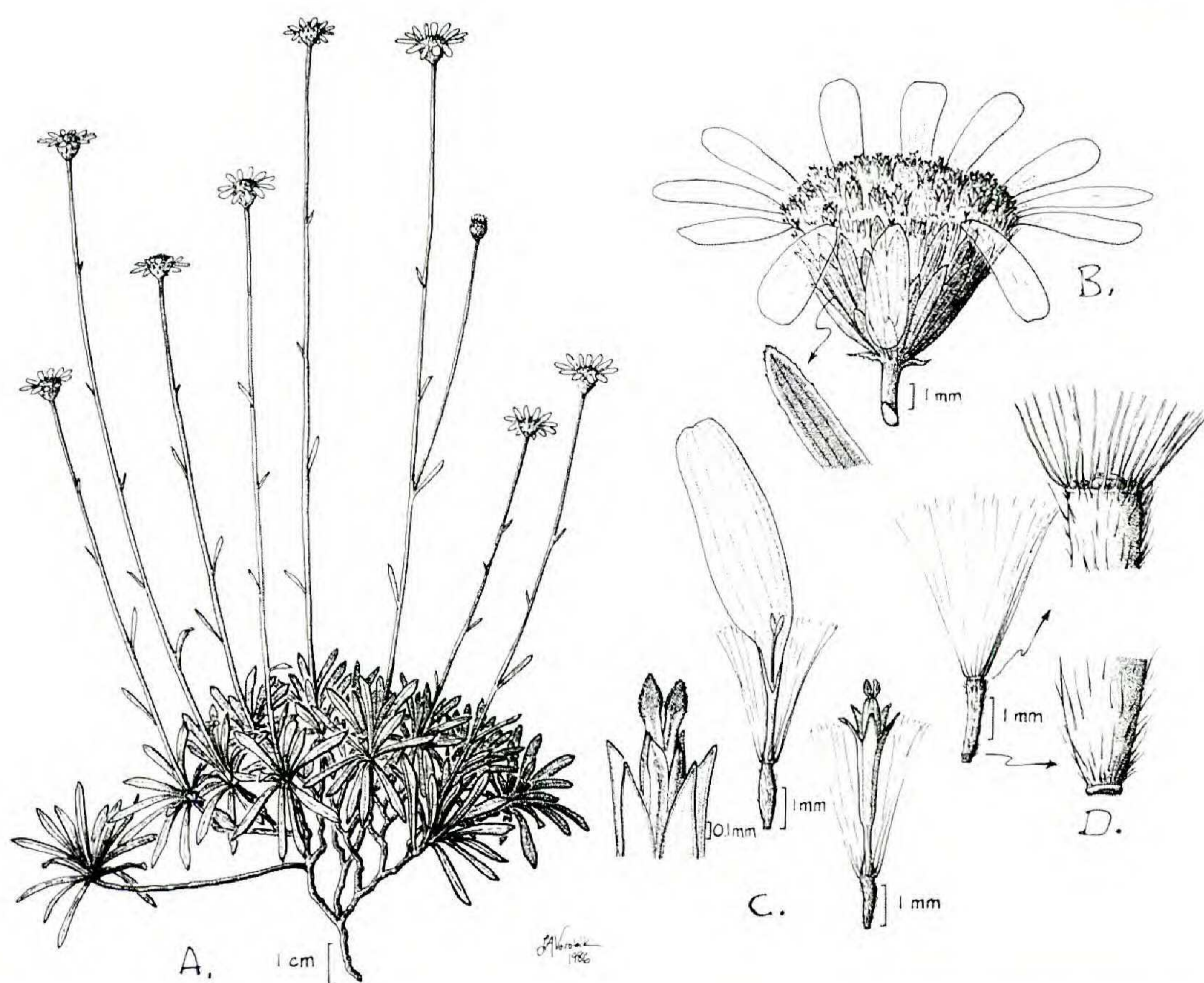


FIG. 1. Habit and morphological details of *Batopilasia byei*.

ceous with scarious margins and 1–3, filiform, orange-resinous nerves, sometimes purple tinged at least on the upper half, the inner series 4–5 mm long, 0.5–0.8 mm wide; receptacles low-convex. Ray flowers 9–18, fertile, the corollas white, drying white or purplish, 5–7 mm long, the lamina 1.4–2 mm wide, coiling at the tips. Disc flowers 24–29, fertile, the corollas 3.5–4.2 mm long, not inflated or indurated, lobes triangular-deltate, erect; style branches with deltate collecting appendages 0.1–0.2 mm long. Cypselas sparsely strigose, cylindrical and terete to slightly flattened, 1.8–2.5 mm long, 0.4–0.5 mm wide, with (2–)4(–5) thin, orange nerves; pappus of 15–27 barbellate bristles 2.9–3.8 mm long and a few outer setae 0.1–0.5 mm long. Chromosome number,  $2n = 18$  (Sundberg & Nesom 1990).

The genus is named for the region of southwestern Chihuahua to which it apparently is restricted. The known populations of *Batopilasia* (as cited in Sundberg & Nesom 1990) occur in Municipio Batopilas, within a radius of about 25–30 kilometers, south of the town of Creel and in the general area of the Barranca del Cobre (Fig. 2). The plants grow on steep rocky slopes, commonly in rock crevices and ledges in arroyos and canyons, in pine-oak woodlands at 2000–2400 meters elevation, flowering May through July. The epithet commemorates Robert Bye, botanist and ethnobotanist who has had a long-standing and active interest in the flora of Chihuahua.



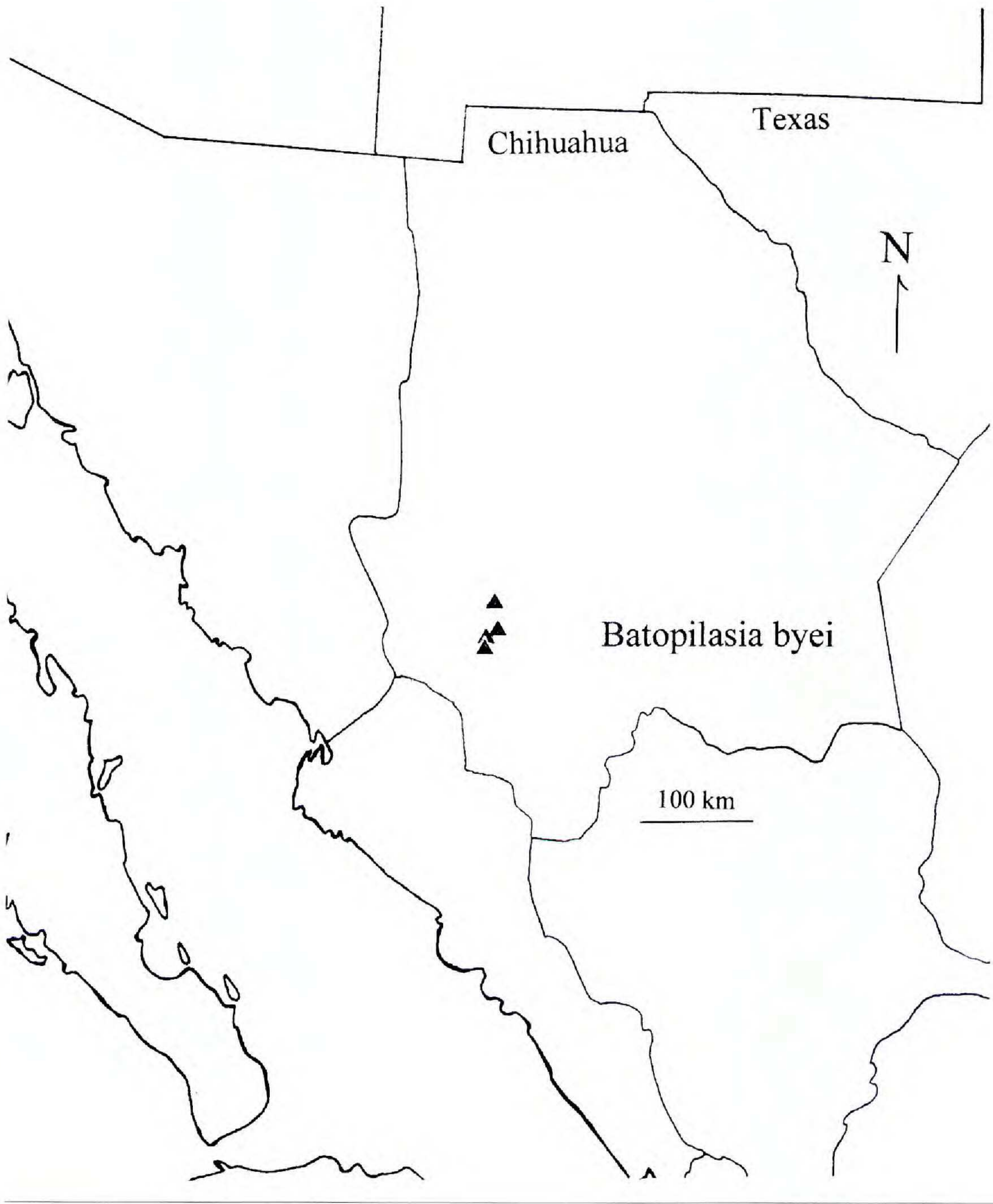


FIG. 2. Geographic distribution of *Batopilasia byei*.

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## REFERENCES

- ANDERSON, L.C. 1987. *Boltonia apalachicolensis* (Asteraceae): a new species from Florida. *Syst. Bot.* 12:133–138.
- CRONQUIST, A. 1980. *Boltonia*. In: Vascular flora of the southeastern United States, Vol. I. Asteraceae. Univ. of North Carolina Press, Chapel Hill. Pp. 168–169.
- GU, H. and P.C. HOCH. 1997. Systematics of *Kalimeris* (Asteraceae: Astereae). *Ann. Missouri Bot. Gard.* 84:762–814.
- MORGAN, D.R. 1990. A systematic study of *Machaeranthera* (Asteraceae) and related groups using restriction site analysis of chloroplast DNA and a taxonomic revision of *Machaeranthera* section *Psilactis*. Ph.D. dissertation, Univ. of Texas, Austin.
- NESOM, G.L. 1989. Infrageneric taxonomy of New World *Erigeron* (Compositae: Astereae). *Phytologia* 67:67–93.
- NESOM, G.L. 1992. Revision of *Erigeron* sect. *Linearifolii* (Asteraceae: Astereae). *Phytologia* 72:157–208.
- NESOM, G.L. 1994. Subtribal classification of the Astereae (Asteraceae). *Phytologia* 76:193–274.
- NESOM, G.L., Y. SUH, D.R. MORGAN, S.D. SUNDBERG, and B.B. SIMPSON. 1991. *Chloracantha*, a new genus of North American Astereae (Asteraceae). *Phytologia* 70:371–380.
- NESOM, G.L. and R.D. NOYES. 1999. Notes on sectional delimitations in *Erigeron* (Asteraceae: Astereae). *Sida* 18:1161–1165.
- NOYES, R.D. 2000. Biogeographical and evolutionary insights on *Erigeron* and allies (Asteraceae) from ITS sequence data. *Pl. Syst. Evol.* 220:93–114.
- NOYES, R.D. and L.H. RIESEBERG. 1999. ITS sequence data support a single origin of North American Astereae (Asteraceae) and reflect deep geographic divisions in *Aster* s.l. *Amer. J. Bot.* 86:398–412.
- SUH, Y. 1989. Phylogenetic studies of North American Astereae (Asteraceae) based on chloroplast DNA. Ph.D. dissertation, Univ. of Texas, Austin.
- SUNDBERG, S.D. 1991. Intraspecific classification of *Chloracantha spinosa* (Benth.) Nesom (Asteraceae) Astereae. *Phytologia* 70:382–391.
- SUNDBERG, S.D. and G.L. NESOM. 1990. A new species of *Erigeron* (Asteraceae: Astereae) from Chihuahua, Mexico. *Phytologia* 69:278–281.